Measurement and analysis of neutron and photon flux spectra inside a Tungsten block irradiated with 14 MeV neutrons

Siegfried Unholzer[1], Mauricio Angelone[2], Paola Batistoni[2], Ulrich Fischer[3], Hartwig Freiesleben[1], Dieter Lichte[3], Cezar Negoita[1], Mario Pillon[2], Klaus Seidel[1]

[1] *Technische Universität Dresden, Institut Kern-und Teilchenphysik, Germany*
[2] *Associazione ENEA-EURATOM, Fusion Division, Frascati, Italy*
[3] *Forschungszentrum Karlsruhe, Institut für Reaktorsicherheit, Germany*

Tungsten is a preferred structural material in fusion devices because of its excellent thermal properties and reduced activation characteristic. As part of the European Fusion Technology Programme a benchmark experiment was carried out in collaboration of TU Dresden with ENEA Frascati and FZ Karlsruhe to test the reliability of nuclear data files for Tungsten. A W block with front area of 47cm x 47cm and 49cm length was irradiated with 14 MeV neutrons at the Frascati neutron generator (FNG), and the induced neutron and photon flux spectra were measured central inside the block at distances of 5, 15, 25, 35 cm from the front area. Both neutron and photon flux spectra were simultaneously measured using the TUD NE-213 pulse height spectrometer. The spectra unfolding was done with the DIFBAS code on base of absolute detector responce matrizes. MCNP-4C calculations with different nuclear data libraries, here the Fusion Evaluated Nuclear Data Libraries FENDL-1, FENDL/MC-2.0 and the European Fusion File EFF-2.4 were tested against the experimental results to proof the accuracy of the used nuclear data. In Monte Carlo calculations a full 3D geometry model of the assembly was taken. The spectra were calculated as average flux in the volume element considered by means of the track length estimator of MCNP. The comparison between experiment and calculations is made in full detail between 1 and 15 MeV for neutrons and between 0.4 and 9 MeV for photons and also in C/E-ratios (calculation/experiment)of significant fluence integrals. In tendency the C/E-ratio decrease for the neutron fluences with increasind depth of the measuring position. Starting from C/E=1 for z= 5cm, the neutron fluence measured is well reproduced within 20

Email: unholzer@physik.tu-dresden.de